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THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Wildrick et al.

Serial No.: 09/964,130

Filed: September 25, 2001

For: Surface Mount Power Supplies for  
Standard Assembly Process

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Group Art Unit: 2827

Examiner: Tuan T. Dinh

Attorney Docket No.: AINNO.0101

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By: Kathleen A. Tolnay  
Kathleen A. Tolnay

**RESPONSE TO OFFICE ACTION**

Assistant Commissioner of Patents  
Washington, D.C. 20231

Sir:

No fees are believed to be required. If, however, any fees are required, I authorize the Commissioner to charge these fees which may be required to Deposit Account No. 50-0392. No extension of time is believed to be necessary. If, however, an extension of time is required, the extension is requested, and I authorize the Commissioner to charge any fees for this extension to Deposit Account No. 50-0392.

In response to the Office Action dated April 24, 2002, please amend the above-identified application as follows:

**IN THE CLAIMS:**

Please cancel claims 3, 15, and 16 without prejudice.

A rewritten version of the claims is as follows:

- B<sup>1</sup>
1. A power module comprising:
    - (a) a board having at least one element mounted thereon; and
    - (b) at least one interconnect for electrically coupling the element to an end user's circuit card, wherein the interconnect is U-shaped, the interconnect further comprising a contact surface having a through hole, said through hole adapted to allow solder paste to flow into the interconnect to form a strong physical bond between the element and the end user's circuit card.
  2. The power module of Claim 1 wherein said interconnect further comprises a conductive structure having a sidewall.
  4. The power module of Claim 1 wherein said board is formed from a plurality of layers.
  5. The power module of Claim 1 wherein said board is formed of FR4.
  6. The power module of Claim 1 wherein said power module further comprises a circuit formed on a plurality of layers.
  7. The power module of Claim 1 wherein said board further comprises a surface for engagement with a pick and plane machine.
  8. The power module of Claim 1 wherein said at least one element is a pair of planar magnetic cores.
  9. The power module of Claim 1 wherein said board is stiffened by a metallic layer within the board.

10. The power module of Claim 1 wherein said at least one interconnect comprises three interconnects that are placed to form a stable plane.

11. The power module of Claim 1 wherein a solder paste is used to couple the interconnect to the end user circuit card.

12. The power module of Claim 11 wherein a thickness of said solder paste is greater than a combined tolerance of the board, the interconnect, and the end user circuit card.

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14. An interconnect for use between a power module and an end user circuit card comprising:

(a) a first sidewall;

(b) a contact surface adapted to contact said end user circuit card, said contact surface having at least one through hole, said through hole adapted for flow of solder paste into the interconnect; and

(c) a second side wall, wherein the interconnect is generally U-shaped and conductive.

17. The interconnect of Claim 14 wherein the height of the first and second sidewalls are approximately identical.

18. The interconnect of Claim 14 wherein the height of the first and second sidewalls are within 2 mils of each other.

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29. A method of coupling a power module to an end-user circuit board comprising the steps of:

(a) applying a solder paste to at least three mounting pads on said circuit board;

(b) placing a power module having at least three interconnects onto the circuit board so that the interconnects contact to solder paste; wherein the solder paste flows through holes in the interconnects; and wherein a tolerance between the interconnects is absorbed in the solder paste; and

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(c) heating the solder paste.

30. The method of Claim 29 wherein step (b) further comprises placing a power module having at least three U-shaped interconnects.

## **REMARKS**

Claims 1-2, 4-12, 14, 17-18, and 29-30 are pending in the present application.

Claims 3, 15, and 16 have been cancelled. Claims 1, 2, 14, and 29 have been amended.

Reconsideration and allowance of the pending claims is respectfully requested.

### **I. Objections to Claims**

With regard to the claim objections, Applicant respectfully submits that Claims 3 and 16 have been cancelled and incorporated into Claims 1 and 14, respectively. In accordance with the Examiner's suggestions, "hole there through" in Claims 3 and 16 has been replaced with "through hole" in independent Claims 1 and 14.

Therefore, it is believed that the claim objections have been overcome.

### **II. 35 U.S.C § 102, Anticipation**

The Examiner has rejected Claims 14-18 under 35 U.S.C. § 102(b) as being anticipated by Schneider et al., hereinafter "Schneider," (U.S. Patent No. 4,362,904). This rejection is respectfully traversed.

With regard to independent Claim 14, this claim has been amended to include, among other things, the limitations of Claims 15 and 16. Accordingly, Claims 15 and 16 have been cancelled. Claim 14 now reads:

An interconnect for use between a power module and an end user circuit card comprising:

(a) a first sidewall;

(b) a contact surface adapted to contact the end user circuit card, the contact surface having at least one through hole, the through hole adapted to allow flow of solder paste into the interconnect; and

(c) a second side wall, wherein the interconnect is generally U-shaped and conductive.

The present invention is directed to a *conductive* interconnect device that is able to facilitate power transfer from a power module to an end user circuit card (page 13, lines 7-8 of the specification). The interconnect's contact surface includes at least one through hole adapted to allow the flow of solder paste into the interconnect, thereby forming a stronger bond (page 13, lines 11-13 of the specification).

In the Office Action, the Examiner stated that "Schneider discloses the interconnect as shown in figures 1-3 wherein said interconnect is conductive (column 2, lines 42-47)." However, Schneider actually teaches a mounting support that is manufactured from *nonconductive* material (column 2, lines 38-40 and column 4, lines 13-15). In Schneider, *external* leads of an electrical component may be inserted through slots in the mounting support. These leads are clipped and soldered to the circuit board (column 3, lines 48-54). Therefore, the *leads of the electrical component*, not the mounting support disclosed by Schneider, conduct power from the electrical component to the circuit board. The nonconductive support structure in Schneider therefore teaches away from the present invention.

Additionally, the Examiner analogizes the present invention's contact surface with Schneider's base 20. However, as indicated in column 3, lines 20-23 of Schneider, the base itself does not make contact with the printed circuit board. Rather, four rectangular feet extend from the base and sit on the board. Schneider further fails to describe the base having at least one through hole adapted to allow the flow of solder paste into the interconnect to physically bond the base with the circuit board. In contrast, the reference teaches the insertion of the leads of an electrical component into support slots in the base. These *leads*, not the support, are then soldered onto the board.

For at least the reasons discussed above, Schneider fails to teach, suggest, or render obvious the presently claimed invention. Schneider actually teaches away from the present invention by disclosing a nonconductive support, while the present invention describes a conductive interconnect. Reconsideration and allowance of independent Claim 14 is respectfully requested.

Claims 17-18 are dependent upon independent Claim 14. Applicants have already demonstrated Claim 14 to be in condition for allowance. Applicants respectfully submit that Claims 17-18 are also allowable, at least by virtue of their dependency on allowable claims.

### **III. 35 U.S.C. § 103, Obviousness**

The Examiner has rejected claims 1-12 and 29-30 under 35 U.S.C. § 103 (a) as being unpatentable over Heinrich et al. (U.S. Patent No. 6,189,203) in view of Schneider (U.S. Patent No. 4,362,904). The foregoing rejections are respectfully traversed for the reasons discussed below.

With respect to independent claim 1, Applicant has amended this claim such that it now reads:

A power module comprising:  
(a) a board having at least one element mounted thereon; and  
(b) at least one interconnect for electrically coupling the element to an end user's circuit card, wherein the interconnect is U-shaped, the interconnect including a contact surface having a through hole, the through hole adapted to allow solder paste to flow into the interconnect to form a strong physical bond between the board and the end user's circuit card.

For an invention to be prima facie obvious, the prior art must teach or suggest all claim limitations. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). In the Office Action, the Examiner acknowledges that Heinrich fails to teach a U-shaped

interconnect having a contact surface with a through hole. (Heinrich instead describes mounting *pins* having substantially flat ends and no through holes (column 10, lines 43-52).) The Examiner attempts to cure the deficiencies of Heinrich by citing to Schneider.

The Examiner states:

Schneider shows a interconnect (10) being formed U-shaped having a sidewall (22; 24) and a contact surface (20), the contact surface includes a through hole (26; 28). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a structure of the interconnect having a U-shape as taught by Schneider to employ the power module and method of PA in order to provide a table against vibrating or other undesired movement of one board mounted to another board.

However, a *prima facie* case of obviousness cannot be properly based upon a prior art reference if the prior art reference requires some modification in order to meet the claimed invention and such modification destroys the intended purpose or function of the disclosed invention in the reference. In the case of the combination of Schneider and Heinrich, in order to achieve the present invention, Schneider's mounting support must be modified to enable the support's base to make contact with an end user circuit card. This requires removal of the rectangular feet (12, 14, 16, 18) of Schneider. A prime motivation behind Schneider's feet is to allow means for wave soldering of the component leads and flushing action for cleaning after soldering (column 2, lines 42-47). By removing the rectangular feet, Schneider's intended function of wave soldering and flushing action is destroyed.

Additionally, in order to achieve the present invention through the combination of Schneider and Heinrich, Schneider's primary function of providing support for electrical components is also destroyed. The present invention teaches an interconnect for *electrically coupling* a board element to an end user's circuit card. Schneider is directed



toward a *nonconductive* mounting *support* for cradling an electronic component having conductive leads. In order to achieve the present invention, Schneider's nonconductive support must somehow be electrically coupled to an end user's circuit card. The motivation for the nonconductivity of Schneider's support lies in the conductivity of the electronic component's leads. By using Schneider's mounting structure as an interconnect for electrically coupling to a board element, Schneider's intended function of support for an electronic component is destroyed. Thus, the presently claimed invention may be reached only through an improper use of hindsight with the benefit of Applicants' disclosure.

Therefore, Applicant respectfully submits that Heinrich and Schneider are not properly combined to render obvious independent Claim 1, as amended. Reconsideration of Claim 1, and all claims dependent therefrom, is respectfully requested.

With regard to Claim 29, Applicant has amended this claim in the following manner:

A method of coupling a power module to an end-user circuit board comprising the steps of:

- (a) applying a solder paste to at least three mounting pads on said circuit board;
- (b) placing a power module having at least three interconnects onto the circuit board so that the interconnects contact to solder paste; wherein the solder paste flows through holes in the interconnects; and wherein a tolerance between the interconnects is absorbed in the solder paste; and
- (c) heating the solder paste.

Claim 29 has been amended to include limitations similar to those in Claims 1 and 14 above. In view of the arguments presented by the Applicant with respect to Claims 1 and 14, Applicant respectfully submits that Claim 29 and all claims dependent therefrom are allowable for at least the reasons discussed above. Reconsideration of Claim 29 is respectfully requested.

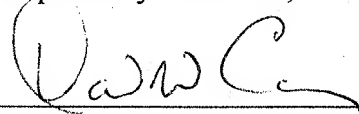
**IV. Conclusion**

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

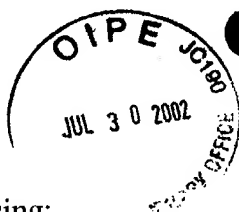
DATE: July 24, 2002

Respectfully submitted,



David W. Carstens  
Reg. No. 34,134  
Carstens, Yee & Cahoon, LLP  
P.O. Box 802334  
Dallas, TX 75380  
(972) 367-2001  
Agent for Applicant

**Appendix Showing Changes Made**



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1. (Amended) A power module comprising:
  - (a) a board having at least one element mounted thereon; and
  - (b) at least one interconnect for electrically coupling the element to an end user's circuit card[]; wherein the interconnect is U-shaped, the interconnect further comprising a contact surface having a through hole, said through hole adapted to allow solder paste to flow into the interconnect to form a strong physical bond between the element and the end user's circuit card.
2. (Amended) The power module of Claim 1 wherein said interconnect further comprises a conductive structure having a sidewall [and a contact surface].
14. (Amended) An interconnect for use between a power module and an end user circuit card comprising:
  - (a) a first sidewall;
  - (b) a contact surface adapted to contact said end user circuit card, said contact surface having at least one through hole, said through hole adapted for flow of solder paste into the interconnect; and
  - (c) a second side wall, wherein the interconnect is generally U-shaped and conductive.
29. A method of coupling a power module to an end-user circuit board comprising the steps of:
  - (a) applying a solder paste to at least three mounting pads on said circuit board;
  - (b) placing a power module having at least three interconnects onto the circuit board so that the interconnects contact to solder paste; wherein the solder paste flows through holes in the interconnects; and wherein a tolerance between the interconnects is absorbed in the solder paste; and
  - (c) heating the solder paste.